Guy Sutton

The brain and crime

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brain
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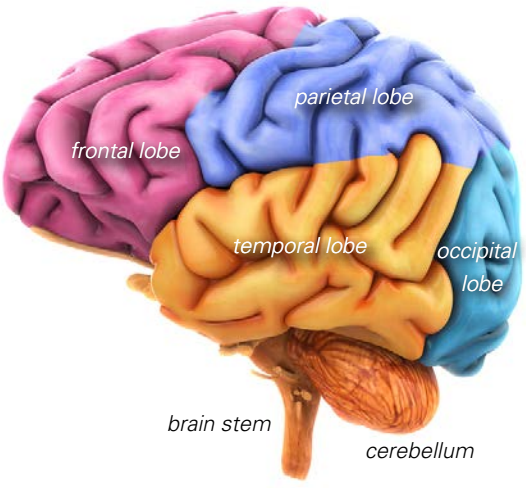
Are criminals 'born or made'? Does brain damage result in criminal behaviour or do some individuals have a genetic predisposition to crime? Or is criminality more likely to be influenced by social factors? Recent research suggests that the social world influences the activity of our genes, in turn affecting brain function. Neuroscientists are now beginning to explore how the brain might be linked to certain criminal behaviours.



The major regions of the human brain

Brain anatomy and function

The brain controls all thoughts and actions. The two cerebral hemispheres are divided into four lobes.

The frontal lobes, comprising around one third of the brain's hemispheres, are involved in mental and behaviour functions such as thinking, personality and control of emotional expression.

- The temporal lobes are involved in memory, together with hearing, smell, and recognising objects and faces.
- The parietal lobes integrate sensory information.
- The occipital lobe is responsible for vision.

Beneath the surface of the brain, complex brain regions exist such as the limbic system. This includes the two amygdalae; one in each hemisphere and involved in emotion, memory, aggression and fear. The hippocampus curves back from the amygdala in each hemisphere and is involved in emotion and memory.

The damaged brain and altered behaviour

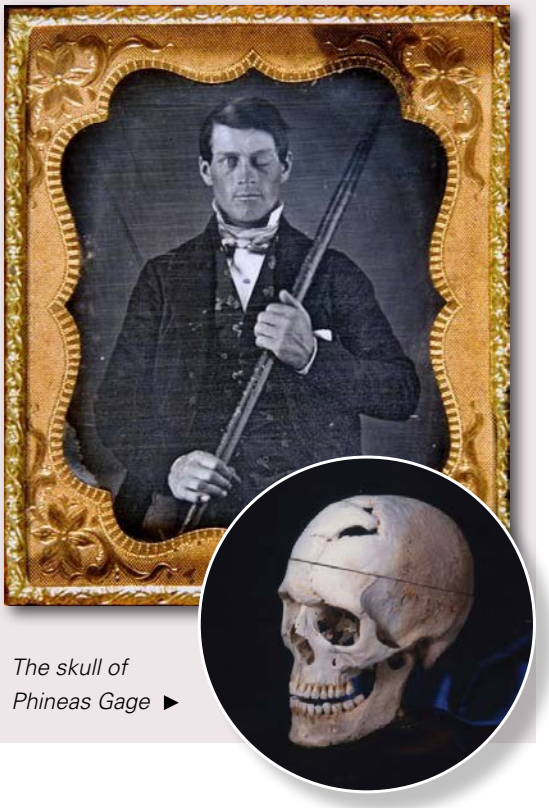
Brain damage could potentially influence behaviour in many ways, for example, by impairing learning or judgement. There is a growing amount of evidence linking brain injury to criminality. Compared with the general population, there is a higher rate of brain damage amongst offenders in custody.

Brain damage in childhood and early adulthood may increase the likelihood of criminal behaviour.

Phineas Gage

In 1848, Phineas Gage, a US construction foreman, was involved in a work-related accident. A three and a half foot long, thirteen pound iron rod was blown into his head, travelling behind his eye and out through the top of his skull, resulting in the loss of much left frontal lobe tissue. Gage survived the accident and his doctor documented his subsequent personality, cognitive and emotional changes. He was recorded as losing his inhibitions, behaving inappropriately and violently, even reportedly molesting his children.

Phineas Gage, seen holding the tamping iron which passed through his skull. ▼

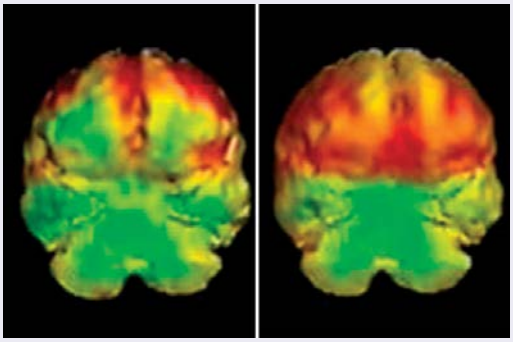


The skull of Phineas Gage ►

Donta Page

In Denver, USA, Donta Page was convicted of the brutal murder of Peyton Tuthill in 1999. Subsequent brain scans found decreased brain activity in Page's ventral prefrontal cortex. It was argued that a catalogue of childhood problems, including poor nutrition, parental neglect, physical and sexual abuse and head injuries, together with a family history of mental illness, had left him unable to control his behaviour. On the basis of his brain pathology, Page's death sentence was reduced to life imprisonment.

Donta Page



Scans of Donta Page's brain (left) and a normal brain. The images show decreased activity in Page's pre-frontal cortex.

Frontal lobe damage

This damage typically lowers inhibitions or emotional control, affecting the way we respond to triggers in the environmental.

However the frontal lobe is a complex structure and can be divided into sub-regions. The prefrontal cortex (PFC), for example, is important in judgement, decision-making and impulse control (sometimes described as the 'crowning achievement' of the human brain, it is one of the slowest brain regions to mature). If damage occurs in childhood, problems developing an understanding of moral behaviour can arise; in adulthood, this damage may be associated with an inability to control inappropriate behaviour.

Reduced activity of the PFC has been implicated in aggression and violence, as exemplified by the case of Donta Page.

The orbitofrontal cortex (OFC) is involved in the regulation of social behaviour and, in one infamous case, displacement of this structure in the right hemisphere by a brain tumour was linked with an individual's 'acquired paedophilia'. After the tumour was surgically removed, behaviour returned to normal. A change in behaviour indicated the tumour had regrown. When it was removed for a second time, behaviour once again returned to normal.

Limbic region damage

Damage to the amygdala and alterations to its function have been linked to aggressive behaviour. For example, epilepsy, localised to the amygdala, may be associated with episodes of aggression in some patients. Brain tumours affecting limbic system function have also been linked to aggressive behaviour, and even to murder such as in the case of Charles Whitman.

Charles Whitman

Charles Whitman was an engineering student at the University of Texas. In 1966 he killed 16 people, including his wife and mother. During the post-mortem examination of his brain a tumour was found near to the right amygdala, which some scientists think might have led to Whitman's inability to control his emotions and actions.

Charles Whitman

In studies of otherwise untreatable aggression, the surgical removal of the amygdala on both sides of the brain is reported to have resulted in moderate to excellent improvement of aggressive in about 75% of patients. There is even evidence to suggest that amygdala dysfunction may also lead to poor fear conditioning which may predispose an individual to crime. One study reported that a failure to form an association between a loud noise and fear at the age of three years appeared to precede criminal activity in adulthood.

Genes and behaviour: nature, nurture or both?

Many researchers over the years have reasoned that criminality may be genetically determined, that there might be a gene or set of genes running in families and predisposing to deviant behaviour.

Behaviours such as impulsivity, which is correlated with antisocial behaviour, appear to be heritable. However, the contribution of any single gene to antisocial and aggressive behaviour is most likely to be very small, with several genetic variants incrementally increasing the risk of antisocial behaviour. Genes interact with clusters of genes, which interact with networks of genes that in turn interact with the environment. Further, when considering the relationship between genes and crime, two important points must be noted. First, when we say that a given behaviour is genetically influenced, this is not to say that it is inevitable or 'determined'. Predisposition is not predestination. Second, when we say that genes influence criminal behaviours, this does not mean that genetics can *explain* why certain individuals commit crime.

A doctor examines a CAT scan of a patient's brain.

Epigenetics is an exciting new development in our understanding of how the environment is involved in the expression of genes and linked to antisocial behaviours. The term is used to describe how environmental factors such as stress, diet and drugs can 'switch on' (express) and 'switch off' (silence) genes. Scientists are trying to understand how early life experiences can alter gene expression patterns in the developing brain, altering development and function of areas such as the hippocampus and frontal lobes. It is possible that there will come a time when, as part of an offender's defence, their legal team argues absence of parental interaction and moral teaching has altered gene expression leading to frontal lobe impairment and an inability to control behaviour?

What can we conclude?

Criminal behaviours and their causes are diverse, leading some philosophers and scientists to comment that it is unlikely we will ever find a brain 'signature'. However, certain types of traumatic brain injury seem to increase the risk of offending behaviour and there is increasing evidence that brain tumours, epilepsy, levels of chemical neurotransmitters in the brain and many other biological factors can increase antisocial behaviour and criminality.

Human behaviours are complex in their origins, arising from an interaction of genes, environment, developmental history, and the evolutionary processes which have shaped brain structure and function. In the years to come, we will inevitably learn more about how these factors interact, influencing criminal behaviours, but at present we must be careful not to misinterpret our limited findings and make generalisations about criminal behaviour without supporting evidence.

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